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Four hundred and forty-three seventh grade pupils in the Los Angeles area were included in a study of the relationships of aptitude and trait measures to teacher ratings of behavioral aspects of creativity. All children had an I.Q. of 90 or greater.

Eight aptitude scores were used as measures of divergent thinking in semantic content. A series of tests were also devised to provide trait scales for dimensions of temperament and interest. Trait scales for boys and girls differ in minor but interesting ways. A third measure was a rating of each child by two teachers, a homeroom teacher and another.

The results of the measures were varied. Non-aptitude or trait tests can be defined and interpreted although reliabilities in these tests were low. Traits in boys are different than those for girls but there seems to be no psychologically interesting patterns in the differences. Teachers may need more intensive training than given in this study, if they are to evaluate differentiated aspects of creative behavior, They tended to let a general "problem-solving syndrome" underlie their perception creativity.

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APTITUDES AND PERSONALITY MEASURES RELATED TO CREATIVITY IN SEVENTH-GRADE CHILDREN

COOPERATIVE RESEARCH PROJECT NO. 1060

P. R. MERRIFIELD
S. F. GARDNER
ANNA B. COX

UNIVERSITY OF SOUTHERN CALIFORNIA

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APTITUDES AND PERSONALITY MEASURES RELATED TO CREATIVITY IN SEVENTH-GRADE CHILDREN

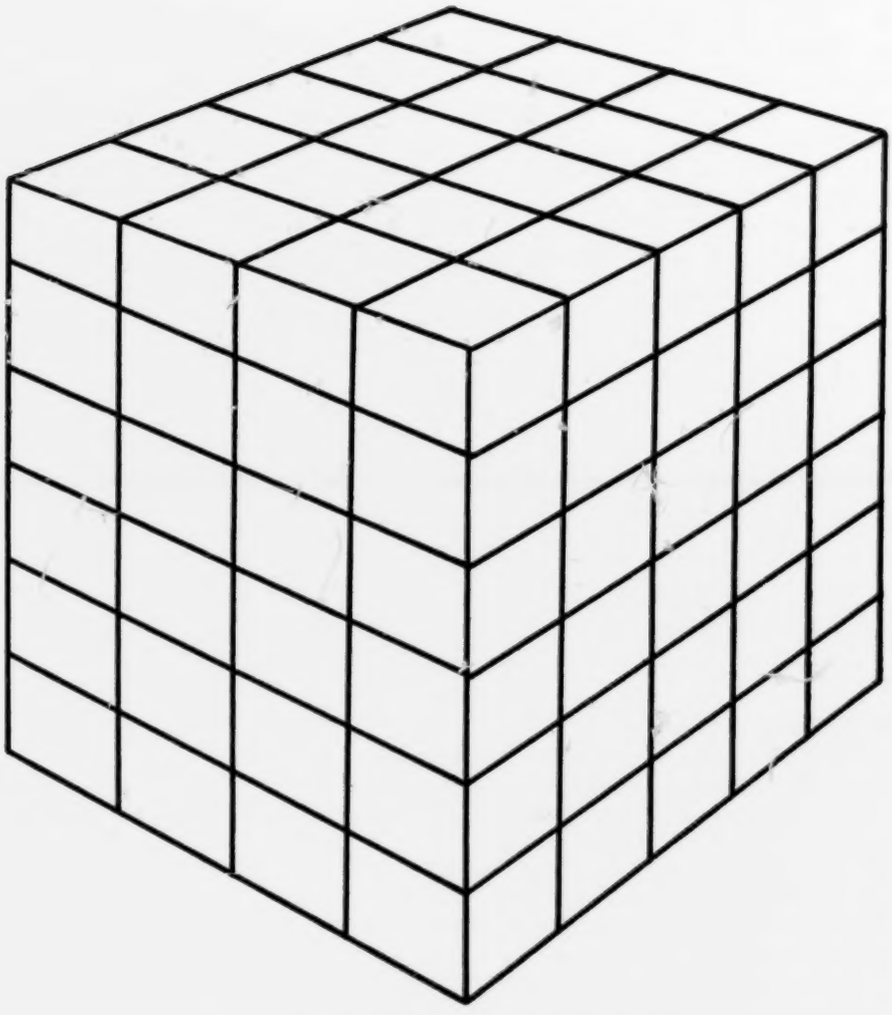
Cooperative Research Project No. 1060

Studies of Aptitudes of High-level Personnel

P. R. Merrifield

S. F. Gardner

Anna B. Cox



REPORTS FROM THE PSYCHOLOGICAL LABORATORY

THE UNIVERSITY OF SOUTHERN CALIFORNIA

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INTRODUCTION

The Problem

The recognition that the position of the United States was challenged in the fields of science and education as well as in the military brought a major impetus to the study of productiveness, inventiveness, and originality. Increasingly, psychologists and educators have addressed the task of selecting children who have the ability to produce new solutions to old problems or to solve problems that have never been considered before. In most of the published research on creativity of children such personality aspects as interests and temperament traits have been overlooked, despite the alleged importance of these attributes in the development and expression of creative ability in adults.

Since 1949, the Aptitudes Research Project[1] at the University of Southern California has produced definitive tests for over 50 intellectual abilities and inventory scales to measure interest in several kinds of thinking. During the first decade, the research was conducted using samples of the male military officer candidate population, mostly those in aviation training schools.

In 1960, a taxonomy of intellectual factors was proposed (10) as both a summary of work done and a source of systematic hypotheses for new investigations. The present research was initiated to explore, using subjects of lower age and less experience, the implications of the "structure of intellect" with respect to the complex of behavior tendencies called, generically, "creativity."

Objectives of the Study

There were four major objectives for the present study. Summarized, they are:

1. To determine whether divergent-thinking factors as defined for adults (10) can differentiate children at the seventh-grade level.

2. a. To define non-aptitude traits that will differentiate these children;
   b. To find whether significant relationships exist between measures of aptitudes and non-aptitude traits.

3. a. To find whether the factor pattern of non-aptitude traits in boys differs from that in girls;
   b. To find whether the relationships in 2(b) are different in boys from those in girls.

4. a. To develop rating scales suitable for teachers' evaluations of aspects of students' creativity;
   b. To determine the contribution of measures of aptitudes and non-aptitude traits to the prediction of the teachers' ratings.

Review of Related Research

At least three studies have been reported in which aptitude tests developed by the Aptitudes Project, or tests very similar to them, were administered to children. Factor analyses revealed divergent-thinking aptitudes similar to those isolated in adults (11, 18, 2), in that the same or similar tests appeared together on the rotated factors. Among the aptitudes isolated for children are ideational fluency, expressional fluency, associational fluency, spontaneous flexibility, originality, and elaboration.

Other studies (20, 7, 13, 5) have used these same tests, or minor revisions, to select children as "high creative" subjects, either for comparison with other groups or to define aptitude measures hypothesized to be correlated with non-aptitude measures. The results of these and other studies have indicated that temperament variables such as tolerance of ambiguity (5), sense of humor (7), perseverance (16), and non-conformity (1) are related to creativity in some non-chance way. To our knowledge, there has not been an extensive study in which a multi-factor temperament inventory was used to relate many temperament traits to many divergent-thinking aptitudes, using children as examinees.

Correlations between selected creative aptitude factors and many temperament factors were obtained in a study by Merrifield, et al. (17) in which the subjects were U.S. Coast Guard, Navy, and Air Force cadets. Although some of these correlations were significantly different from zero, most were too small to mention. Two studies (5, 16) of children suggest that creative aptitudes and temperament traits may be more highly correlated in that age group than in adults.

There is considerable disagreement in research findings regarding the degree of differentiation of creative aptitudes in children. Some investigators found very few factors differentiated in studies at the intermediate grades (5, 12) or even in the high-school grades (2). On the other hand, analyses of more extensive collections of tests yielded factors quite similar to those for adults from the responses of children at ninth-grade (11), sixth-grade (18), and fifth-grade (14) levels.

[1] Supported prior to 1959 by the Office of Naval Research, and since by ONR, the Cooperative Research Branch, U. S. Office of Education, and the National Science Foundation. J. P. Guilford is Director; Merrifield was Assistant Director; Gardner and Cox were research associates directly involved with the study reported here. Dr. Merrifield is now at System Development Corporation, Santa Monica, Calif., and Dr. Gardner is on the staff at the Mental Health Center of Western North Carolina, Asheville, N. C. The authors wish to thank the Aptitudes Research Project, especially Mr. R. Hoepfner and Mrs. M. Tolson, for preparing this report for publication.

Previous studies have also disagreed about the relationship between intelligence and creativity. In general, a high correlation between IQ measures and creativity measures has been found when a wide range of IQ obtained (8, 4, 15, 16). For subjects with very high IQ, the correlation with creativity tends to be low (20, 11, 7, 5).

Validity information in the area of creativity in children is not plentiful. Ratings by teachers as criteria have been generally unsuccessful. In most studies it was suggested that the teachers were so highly influenced by the degree of differences in intelligence of the ratees that correlations between other variables were obscured (14, 20, 8). In one study, where the scale descriptions were based upon Guilford's description of factors, the teachers' ratings were not considered "appropriate" criteria by the investigators (13).

An extensive review of the literature on creativity in children can be found in (6).

HYPOTHESES

It seems inevitable that a new notion is considered an entity, indivisible. As it was for many years with "intelligence," so much of the current literature reflects the implicit idea that "creativity" is a unitary construct. Yet if Guilford and Merrifield (10) are correct, "creativity" is a composite of rather separate aptitudes and perhaps some non-aptitude traits of personality. It is not surprising that ratings of a vague whole are poorly predicted by measures of but a few of the components involved. Nor is it surprising, in terms of repeated factor-analytic results (11, 14, 18), that the fluent child is not always original, nor the original child necessarily adept at elaboration.

To pursue the objectives using omnibus or overly general measures seemed pointless, but differential measures of aptitudes, temperament traits, and aspects of "creativity" were not available. Thus a large part of this report deals with the development of measures appropriate for testing the major hypotheses.

In general, the hypotheses tested fall into two categories: those dealing with the separate measurability of the constructs involved; and those dealing with relations between the constructs. Those of the first category are given specifically in the Procedures section under the appropriate heading of aptitudes, traits, or ratings.

With regard to the relations between constructs, it was hypothesized that aptitude and trait measures would, in general, have low intercorrelations, reflecting the near-independence of those domains. It was further hypothesized that ratings of aspects of "creativity" and other attributes would be predicted to a greater degree by aptitudes than by traits, and that the prediction of ratings by a composite, as in multiple regression, would be greater than the prediction of ratings by a measure of IQ alone. Details of the specific hypotheses testable using the obtained measures are presented at the beginning of the Results section of this report.

PROCEDURES

In this long chapter are presented the attributes of the sample, the relevant details of administration of tests and ratings, and the descriptions of the measures obtained in order to test the hypotheses. Three types of measures were sought: aptitude scores; trait scores; and ratings on various aspects of behavior, including "creativity." Each type of measure has its own subsection. The final paragraphs of the section constitute a recapitulation of the procedures used to obtain the necessary measurements.

The procedures used in testing the hypotheses were standard techniques for comparing zero-order correlation and multiple-regression coefficients, and for testing their values for significance under the hypothesis of no correlation (or no regression). Further details are provided as necessary in the Results section.

Subjects

The subjects used were drawn from the entire seventh grade of a cooperating school district. The seventh grades were located in two junior high schools, called schools "A" and "B" in this study, assignment of pupils to schools being made on a geographical basis. The school district is in a beach community southwest of Los Angeles. There is considerable pride and interest in the town regarding the progressive attitudes and high standards of the educational program, which is subsidized entirely by income from municipally-owned oil wells. Measures of socioeconomic status in the same community have been discussed in a previous study (19). Assignment to social categories is extremely difficult because the majority of parents are engaged in aircraft, missile, or electronics work for which there are no precedents in published methods of determining indexes of status. However, the two schools and the town can be described as predominantly middle class. The town has no slums and no mansions.

Many of the subjects of this study had taken part in a research project the previous year, 1959, when they were sixth graders (19). Some form of each of the aptitude tests administered in this study had been administered in the earlier study (18).

Of the total of 594 seventh graders registered in Fall 1960, 227 boys and 216 girls were included in the present study. Criteria for excluding subjects were the following: failure to complete any part of the testing because of absence, CTMM IQ below 90, or no available CTMM IQ score obtained within a year of the administration of this battery.

In Table 1, the IQs are presented for the school and sex groups. IQs were computed as averages between language and non-language IQs in a manner described in the manual for the California Test of Mental Maturity. Because the exclusion of subjects whose IQ was lower than 90 left the distribution truncated, the scores were converted for later use to "vingtile" scores (the percentage of cases included for C-scale scores was halved), as shown in Table 2.

Table 1

CTMM IQ Score Means

Schools	Boys	N	Girls	N	Total	N
A	108.82	100	108.83	108	108.83	208
B	112.53	127	114.93	108	113.64	235
A and B	110.90	227	111.88	216	111.38	443

Table 2

Vingtile Conversion of CTMM IQ Scores

C/2 Score	CTMM Interval	Frequency
20	148 - 158	3
19	144 - 147	1
18	140 - 143	6
17	136 - 139	9
16	130 - 135	21
15	128 - 129	11
14	124 - 127	29
13	121 - 123	24
12	117 - 120	44
11	114 - 116	24
10	111 - 113	38
9	107 - 110	61
8	104 - 106	40
7	102 - 103	21
6	99 - 101	38
5	97 - 98	15
4	95 - 96	30
3	93 - 94	11
2	92	9
1	91	2
0	90	8
	Total	443

Children who were present for all three sessions but had no CTMM total IQ score on file were given the missing part or parts of the CTMM within two weeks following administration of the Inventory and the aptitude tests.

Approximately two weeks after the Inventory and tests were administered, Gardner and Merrifield met with the teachers to discuss the rater's manual and the rating scales. These materials are described in the Ratings subsection below. At that session rating manuals and forms for rating the teacher's homeroom class were distributed. Two weeks later and four weeks from the time of the test administration, another discussion of the rating procedure was held and forms for rating the teacher's "non-homeroom" class were distributed. The rating scales were identical with those used by homeroom teachers, but the ratees were, of course, different. Ratings by homeroom and non-homeroom teachers were used as criteria in the correlational analysis.

Administration

Seven aptitude tests and the Inventory of Children's Interests, described in the following two subsections, were administered in each of eighteen homerooms. Classes were suspended during testing and the homeroom teacher served as proctor. Administrators were graduate-student research assistants on the staff of the Aptitudes Project. In order to keep the testing to one 45-minute period each day, the Inventory was given on the first day and the tests on the two successive days, grouped as indicated in Table 3.

Table 3

Inventory and Aptitude Tests Administered

Content	Instruction time (in minutes)	No. of Parts (in minutes)	Time/Part	Total Time (in minutes)
Booklet A				33
Inventory	3	1	30	33
Booklet B				37
Ways to Use It	3	2	5	13
Marking Speed	3	1	1	4
Four-Word Sentences	3	4	2	11
Names for Stories	3	2	3	9
Booklet C				36
Similar Words	3	2	4	11
What Would Happen	3	4	2	11
Making A Plan	4	2	5	14

In June, very close to the end of the school term and approximately six months after the first ratings, forms were distributed for the re-ratings of non-homeroom classes. These data are incomplete because of the attrition in teachers and students. The re-ratings of non-homeroom classes posed a special problem in School "B," because a delay in distributing forms to teachers in this group led to a conflict with the final reports for the end of the year. There was considerable resistance toward re-rating non-homeroom classes. The second set of ratings were not used in this report, except to give some evidence of rater reliability. Further data is given in the Ratings subsection below.

Measures Obtained

This section includes three subsections devoted to the development of aptitude measures from tests, trait measures from the Inventory of Children's Interests, and ratings of aspects of behavior of the children as evaluated by their homeroom and non-homeroom teachers. Because of sex differences in the responses to the Inventory, it was decided to investigate boys and girls separately in as nearly parallel a fashion as the data permitted. Numbers were assigned to the measures for convenience in tabular presentation and discussion; the numbering system, in general, is as follows: for boys, aptitudes are numbered 1 through 9, traits are numbered 10 through 17, homeroom teacher ratings are numbered 18 through 30, non-homeroom teacher ratings are numbered 31 through 43, total IQ vingtile is numbered 44; for girls, 50 is added to the number used for boys.

Aptitudes

The tests used yield measures of six aptitude factors and one reference marker for speed of writing. Two of the tests were scored to yield measures of two factors, consistent with previous studies (11, 18). The factors measured constitute the divergent-thinking semantic column of the structure-of-intellect model (10). They are listed below in the usual order of products. The more familiar name is included in parentheses.

Measures were assigned numbers for convenience in data processing, essentially in the order of the tests in Booklets B and C. Working times are shown in Table 3 above. The names of the adult forms had been considered inappropriate in the study of sixth graders (18, 19), and new names had been given the tests. The names used in this study are the same as in the sixth-grade study. The name of the adult form is included for reference. Modifications of test items and deviations from adult scoring criteria are described following the listing of factors and tests.

DMU - Divergent production of semantic units (ideational fluency). Production of many ideas appropriate in meaning to a given idea.

9, 59. What Would Happen - Obvious (Consequences). List many consequences of a change; the score for ideational fluency is the total number of responses that are directly related to the presented change.

5, 55. Names for Stories - Low (Plot Titles). Write titles for paragraphs based on nursery rhymes; the score is the total number of acceptable titles judged to be non-clever.

DMC - Divergent production of semantic classes (spontaneous flexibility). Production of many categories of ideas appropriate in meaning to a given idea.

1, 51. Ways to Use It (Utility Test). List many different uses for a common object; the score is the total number of times the class of object is changed during the listing.

DMR - Divergent production of semantic relationships (associational fluency). Production of many relationships or associations appropriate in meaning to a given idea.

6, 56. Similar Words (Associational Fluency). Write as many synonyms as possible for common words.

DMS - Divergent production of semantic systems. Ability to produce a variety of ideational systems from a known set of idea units.

3, 53. Four-Word Sentences (Expressional Fluency). Write many different four-word sentences, the first letter of each word being given. The score is the total number of sentences produced, weights being given for productions according to the number of non-duplicated words used.

DMT - Divergent production of semantic transformations (originality). Production of a number of changes of interpretation, neither immediate nor obvious, that are appropriate to a general requirement.

8, 58. What Would Happen - Remote (Consequences). The total number of responses that are indirectly or "remotely" associated to the stated change, i.e., one or more thought states intervene between the given change and the response.

4, 54. Names for Stories - High (Plot Titles). The total number of titles judged to be clever or witty, or succinct.

DMI - Divergent production of semantic implications (elaboration). Production of a number of antecedents, concurrents, or consequents of given information.

7, 57. Making A Plan (Planning Elaboration). List many details of a planned activity.

Reference factor for speed of writing.

2, 52. Marking Speed. Make many "X's" in closely spaced squares within a limited period of time.

Modifications of Tests and Scoring. The distributions of scores on similar tests administered the previous year to many of these subjects (18) were skewed or truncated to such a degree that all measures were dichotomized, with a resulting loss of information. Although the factor structure emerged from those data essentially as hypothesized, it was considered desirable to modify the tests and to relax the adult criteria used in evaluating the sixth-grade responses, in the hope of obtaining more usable information for the multiple-regression portion of the study.

Generally, for tests that had produced a narrow range or skewed distribution of scores for sixth graders, parts or items were added, time limits were cut to reduce boredom (a frequent complaint of sixth graders), and more examples of "high level" responses were provided in the sample items for the appropriate tests.

In Names for Stories, the items were changed to familiar nursery rhymes to decrease the possible influence of reading comprehension. Credit for ideational fluency was given for titles that restated part of the text, even in the exact words of text, so long as the title reflected the essence of the content of the story. The criterion of "cleverness" for the originality score was lowered to increase the range of scores. No credit was given for restatement of a nonessential aspect of the story's text.

For Similar Words new stimuli were selected; a word was used as a stimulus only if many of its synonyms, as listed in Webster's Dictionary, also had high frequency in the Thorndike-Lorge list, or were judged by the investigators to be common in the language of seventh graders.

The instructions to Four-Word Sentences were modified for greater clarity. The items were also revised somewhat to allow for a fourth part to this test. Part credit was given for the sentences in which a word was duplicated from a previous sentence; four points were given for sentences with four original words; two points where one word was duplicated; and no credit where more than one was duplicated. Misspelled words were accepted so long as the first letter was correct and in a few cases credit was given even when a commonly misspelled word used the wrong first letter (e.g., "now" for "know").

One part of What Would Happen was dropped, leaving four parts. A "remote" response was added to those listed for the sample item. Unlike previous scoring, any practicable solution to the change described in the item was given a "remote" score. Because seventh graders tended to list consequences in very narrow categories, a series of closely related responses that were not directly associated to the presented change sometimes resulted; for these cases, only the first response received a "remote" score and the remaining responses in that series were scored "obvious."

The sample responses in the instructions to Making A Plan were made more different from each other to discourage the listing of too similar responses. No credit was given for responses that were judged to be too similar to previous responses.

With these exceptions, adult standards for scoring applied.

Aptitude Measures Used. The tests were scored in sequence by class; within the class groups, subjects were arranged alphabetically. Each test was scored by at least two research assistants, with major discrepancies being resolved by Gardner and Cox. Means, standard deviations, and reliabilities were computed for the raw scores for boys and girls separately, with the results shown in Table 4. Because the raw scores were skewed, and in some cases truncated, in spite of the modifications introduced to avoid those outcomes, the raw scores were converted to deciles for later use in the multiple regressions.

Table 4

Distribution Statistics, Reliabilities, Means, and Standard Deviations of Aptitudes. Boy and Girl Samples

Variate	Test Scores			Reliabilities[a]		Means		Standard Deviations	
	Low	Median	High	$r_{tt}B$	$r_{tt}G$	B	G	B	G
1-51 Ways to Use It	0	3	26	.69	.75	5.31	5.24	1.70	1.96
2-52 Marking Speed	0	73	99	.82	.82	4.79	5.63	1.89	2.10
3-53 Four-Word Sentences	0	15	56	.65	.70	5.14	6.01	1.61	1.77
4-54 Names for Stories (High)	0	2	13	.58	.75	5.39	5.54	1.78	2.02
5-55 Names for Stories (Low)	0	8	20	.75	.79	5.00	5.59	1.82	1.98
6-56 Similar Words	2	14	33	.66	.76	4.71	5.60	1.73	2.02
7-57 Making A Plan	1	14	30	.61	.77	4.77	5.69	1.81	2.03
8-58 What Would Happen (Remote)	0	3	18	.45	.57	5.11	5.78	1.62	1.93
9-59 What Would Happen (Obvious)	1	9	31	.64	.61	5.09	6.26	1.91	1.84

[a] Estimates based on Spearman-Brown prophecy formula applied to correlations between alternate forms (parts)

Traits

This subsection includes a description of the development of the items for the Inventory of Children's Interests and the results of a series of factor analyses leading to the trait measures used.

Sources of Items. A factor analysis of adult responses to items dealing with interests in various kinds of thinking, as well as other selected traits (9, 17), served as the basis for the investigation of children's interests in thinking. Additional items were written to emphasize the differentiation of the traits found in adults and to present the traits in context more familiar to children. From the resulting pool of almost 500 items, 120 items were assembled and subjected to a pretest and an evaluation by adult judges.

Pretesting. The preliminary form was administered to 50 eighth graders in the summer session of the cooperating school district. Their responses were utilized for inter-item correlations, item "difficulty," and reliability of tentative scales. Any item to which more than 70% responded in the same direction was revised or eliminated on the grounds that it would not contribute to differentiation of the sample in terms of its trait. Any item having a low correlation with items logically related to the same construct was eliminated.

Adult Judgments. Eighteen psychology students assigned each item to one of eight trait definitions used as a basis for constructing the inventory (3). After the composite ratings were computed, it appeared that the judges assigned about 25% of the items to scales other than the one intended by the item writer. These items were eliminated.

The Inventory of Children's Interests. As a result of the pretesting and adult judgment procedures, an attempt to use subscales of 2 to 5 items as measures was abandoned because of the very low reliability of many of the subscales. It was decided to carry out a factor analysis of items based on the responses of the subjects used in the study, hoping that the interpretation of the obtained factors would be straightforward. New items were written to replace those eliminated, and many of those retained were reworded to improve their univocality, as it was desired that each item load on only one factor. The final form of the Inventory contained 121 items; each was to be answered by circling the word "yes" or "no" printed after the item in Booklet A (see Table 3).

The Inventory was administered in the classes as previously noted. The examiner read the items aloud, while the children read them silently, and the children marked their answers on the booklet. This form of pacing was useful because of the limited time available and because it was necessary that each child respond to each item.

IBM cards were punched for the responses, "yes" being entered as 1 and "no" as 2. A matrix[2] of phi coefficients was obtained and inspected for clustering of items. It should be noted that the sign of the correlation coefficient, using the data entry procedure described, indicates the direction of the response. The magnitude, as usual, indicates the amount of agreement in response tendencies.

Factor Analysis of Selected Items. On the basis of the emergent clusters and the expected factors, sets of 60 to 70 items were used in a series of four parallel factor analyses, using the same items for boys and for girls, but factoring the intercorrelations separately. Principal-component factors were extracted from the matrix of phi coefficients. Adjustment of these coefficients was considered unnecessary because the item means were relatively the same and the major concern of the analysis was the factor structure, not the specific value of a loading. Items were carried forward to the next analysis if they appeared to be univocal, had appeared in consistent clusters with the same items, and had a relatively high communality. Varimax rotational solutions were inspected and formed the starting point for graphic orthogonal rotations. The sequential approach was necessary because the program available would accommodate no more than 80 variables.

The two final analyses, on which the trait scores were based, were of items that had survived the four preliminary analyses for each sex. Graphic orthogonal rotations of the principal components were made, with the results summarized in the following listing. It should be noted that, although the analyses for boys and girls were made on the same items, the factors obtained were in some cases sufficiently dissimilar that different trait names were given them. The listing indicates the nearest approach to parallel factors that was apparent, although no coefficients of congruence were computed.[3]

Trait Measures Used. Scales from Boy Sample.

10. Persistence--the disposition to stick to a task until it is completed, despite varying degrees of obstacles to completion. This trait does not describe the pathological extreme of rigidity suggested by "perseveration."

    42. You are the kind of person who keeps trying, no matter how hard the job is.
    89. Once you start working on your homework you like to keep working until it is finished.

11. Spontaneity--the disposition to act without contemplation or planning, on the spur of the moment, to act without waiting for much information.

    109. You would rather do things without planning.
    61. You are the kind of person who says the first thing that comes to mind.

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[2] All computations were carried out at the Western Data Processing Center, Graduate School of Business Administration, University of California at Los Angeles, using available programs for the IBM 7090.

[3] The phi correlation matrix of 121 items from the Inventory of Children's Interests for boys and for girls can be obtained on request from: Secretary, Aptitudes Research Project, Department of Psychology, University of Southern California, Los Angeles, California 90007.

12. Impulsiveness--the disposition to act with poor conscious control over impulses, to be irresponsible, and/or to act with poor judgment.

1. Any money you get hold of seems to go as quickly as it came.
7. You buy things that you later realize you don't need.

13. Need for Rules--a need for explicit and absolute rules and laws, and for strict enforcement of rules.

116. People must have rules to know what to do.
98. A good scout troop should be run strictly by the rules.

14. Appreciation of Originality--a liking for wild, humorous, silly, and original ideas; a perception of oneself as a humorous person.

108. You like to tell jokes.
58. You like to be with people who sometimes act silly.

15. Self-confidence--confidence in one's ability, optimism about the future, and assurance that others are interested in and accept one.

115. People generally like you.
113. You are usually confident of your abilities.

16. Adaptive Flexibility--the disposition to be flexible in attitude and in problem solving, involving the belief that changing set is helpful in arriving at solutions.

110. Many problems have a number of good answers.
9. You frequently think of many different ways to do the same thing.

17. Fluency of Ideas--the disposition to produce a quantity of ideas; a perception of oneself as an idea producer.

57. You usually get many ideas about how to do something.
21. When your group is trying to think of something different to do, you can usually make a suggestion.

Trait Measures Used. Scales from Girl Sample.

60. Persistence--the disposition to complete and perfect a task despite obstacles. This trait does not describe the pathological extreme of rigidity suggested by "perseveration."

42. You are the kind of person who keeps trying, no matter how hard the job is.
78. You sometimes do things over and over to get them better, even if you don't have to.

61. Initiative--the disposition characterized by desire for change, independence, and decisiveness.

49. Other people usually take longer to get started than you do.
41. You prefer a teacher who gives you general assignments and has you work out the details for yourself.

62. Lack of Restraint--impulsive expression, resulting in unreflective acts, in an inability to complete tasks, and in a lack of caution in social relationships.

25. It is hard for you to keep from interrupting when someone else is talking and you have something to say.
61. You are the kind of person who says the first thing that comes to mind.

63. Need for Authority--a need for explicit, absolute, strict, and inflexible external structuring, as well as an unquestioning respect for authority.

111. The penalty for the same crime should be the same regardless of special circumstances.
2. It is always better when the class minds the teacher without asking a lot of questions.

64. Appreciation of Originality--an appreciation and preference for humorous, unusual, and original ideas that others produce.

69. Your friends know a lot of funny jokes.
108. You like to tell jokes.

65. Self-confidence--confidence in one's ability, assurance that others are interested in and accept one, and decisiveness.

113. You are usually confident of your abilities.
54. People are right who think you are "on the ball."

66. Tolerance of Ambiguity--flexibility in attitudes, a willingness to consider alternative solutions and different approaches, together with a belief that people do not need structure and restrictions.

120. There is some good even in the worst people.
9. You frequently think of many different ways to do the same thing.

67. Moral Relativism--a desire for less strict, less absolute, and less restrictive authority and rules, and a belief in leniency when conditions warrant breaking rules.

56. A person should be excused for breaking a rule he didn't know about.
62. There are too many laws.

Interpreting the appearance of a trait in the boy sample but not in the girl sample, or conversely, may lead to some confusion. Factors are dimensions, and the presence of a factor in measurements from a sample means that the sample is heterogeneous with respect to that set of measurements: individuals in the sample can be differentiated from each other by that measurement. On the other hand, if an expected factor does not emerge, it means that the sample is homogeneous with respect to measurements of that factor. The presence of a factor in one sample but not in another does not support the inference that the first sample, as a group, has more of the factor or trait than does the second sample.

The complete factor matrices for the final analyses may be found in (6) where the results are discussed further; ten factors in the boy sample and nine in the girl sample were considered interpretable. Reported here are the eight in each sample which seemed most nearly parallel and more clearly interpretable, and thus useful in meeting the objectives of the study.

Trait Measures Used. Trait scales were defined as sets of items, like those given as examples above, that had loadings greater than .30 in absolute value on the factor, or greater than .20 if that were the highest loading of the item and the content of the item was psychologically consistent with that of items already used in interpreting the factor. For a few items having loadings greater than .30 on more than one obtained factor, an assignment to one of the factors was made on logical grounds, so that the trait scales are experimentally independent. Some correlation between scale scores is thus introduced, but, for the decrease in psychological independence, it was hoped that the reliability of the scale to which the item was assigned would increase.

It may be typical of scales based on factor-analyzed items that scale score distributions are skewed. At any rate, most of those resulting from the analyses described above were skewed to some degree. Four scales for boys and five for girls were sufficiently non-symmetric that scores from them were dichotomized for later use. Had there been more items on the factors, and thus a greater range of scores, it should have been possible to C-scale the trait measures, but such was not the case. Internal-consistency estimates of reliability were computed; a few of the resulting values are lower than one would ordinarily expect from the factor-analytic approach. Distribution statistics for the trait measures used in this report are presented in Table 5.

Table 5

Distribution Statistics for Trait Scales

A. Boy Sample	No. of Items	Means	Standard Deviation	r_{tt} [a]
10. Persistence	7	4.23	1.52	.28
11. Spontaneity	8	0.54*	0.50	.55
12. Impulsiveness	5	2.84	1.26	.36
13. Need for Rules	8	4.03	1.89	.56
14. Appreciation of Originality	5	0.56*	0.50	.45
15. Self-confidence	6	4.29	1.49	.38
16. Adaptive Flexibility	5	0.37*	0.48	.41
17. Fluency of Ideas	4	0.61*	0.49	.35
B. Girl Sample				
60. Persistence	7	0.61*	0.49	.64
61. Initiative	5	0.51*	0.50	.29
62. Lack of Restraint	6	0.44*	0.50	.64
63. Need for Authority	7	3.59	1.64	.55
64. Appreciation of Originality	6	0.41*	0.49	.48
65. Self-confidence	7	4.26	1.62	.54
66. Tolerance of Ambiguity	6	0.45*	0.50	.19
67. Moral Relativism	4	2.33	0.99	.47

[a] Estimated by Kuder-Richardson formula 20.
*Dichotomized.

Ratings

For the purpose of obtaining criterion measures, 16 rating scales were devised. The description of each aspect of behavior to be rated was based on either the technical description of the aptitudes measured by the tests used (10), expanded by appropriate contextual examples, or the description, in non-technical language augmented by examples, of the non-aptitude traits expected to be measured by the Inventory. Three of the 16 were later dropped from the study because of low reliability or because no appropriate predictor was found in the analysis of the Inventory.

Attributes to be Rated. The listing below is adapted almost verbatim from the manual prepared for the raters. The sequence is the same as that in the raters' manual, and was determined by the investigators' judgments of relative interest and by an intentional scrambling of specifics from three categories: aptitudes; temperament traits or interests; and general behavior patterns. In the instructions to the raters, they were encouraged to respond fairly rapidly with their first impression, and asked to rate their entire class on one attribute before going on to the next attribute; it was suggested that different attributes be rated on different days. A total of about two weeks was allowed for each rater to evaluate two classes on the 16 attributes. The four numbers indicate the combinations of boy-homeroom, boy-non-homeroom, girl-homeroon, and girl-non-homeroom. The reasons for separating by sex were discussed in the preceding section on Traits; separation by homeroom and non-homeroom was made after examining the ratings, as discussed below.

18, 31, 68, 81. Creativity: the ability, interest, and personality needed to produce many different inventive and original ideas, as well as the ability to shift from one task to another.

19, 32, 69, 82. Impulsiveness: the degree to which the student acts or makes decisions without first making a plan. A very high rating on this scale means that the student often acts impulsively or sometimes exhibits behavior which is very impulsive, that is, he acts whenever the urge arises, even if the action is socially unacceptable. The student may even give the impression that he cannot voluntarily control his behavior. A very low rating on this scale means that the student either seldom acts impulsively or acts the opposite, that is, he is very controlled and restrained. He will seldom do anything without planning beforehand. Note: This pattern does not refer to the worth of a plan nor to the ability to produce a successful plan of action.

20, 33, 70, 83. Recognition of Implications: the degree to which the student can recognize many relevant details of a situation or action. For example, the student who has this ability to a high degree can plan ahead because he can analyze a problem or situation and see what is needed and the many steps involved. Also involved are: the ability to understand the consequences of one's own actions and thus use the knowledge to make detailed plans; the ability to recognize the many implications of one's own behavior; and the ability to think of many alternative antecedents to a given situation.

21, 34, 71, 84. Need for Variety: the degree to which the student needs frequent change and new experience. This need is demonstrated by the student who shows an active desire for change for its own sake. A very high rating on this scale means that the student is easily bored and desires constant change. A very low rating on this scale means that the student seldom displays a desire for change and may even be reluctant to try something new.

22, 35, 72, 85. Spontaneous Flexibility: the degree to which the student typically shifts his mode of response, or method of approach to a problem, apparently for the sake of the change, even though the first mode or method works. This ability is demonstrated by the student who spontaneously shifts from one category to another, when asked to list things.

23, 36, 73, 86. Adaptive Flexibility: the degree to which the student can shift from one method of approach to another, when the shift is made necessary because the original method does not work. The student who demonstrates this ability can reorganize a complex design to see many different patterns or can see how to use a given object to solve a problem with which the object is not usually associated.

24, 37, 74, 87. Self-confidence: the degree to which the student has confidence in his ability. This tendency is demonstrated by the student who feels comfortable in the classroom, certain of being accepted by teachers and peers, and positive that he can perform adequately in class. A very high rating on this scale means that the student almost always is sure of his ability or demonstrates unusually extreme self-confidence. A very low rating on this scale means that the student is seldom sure of his ability or acceptance by others. The student who appears to be convinced that he is inferior or inadequate would get a very low rating on this scale.

25, 38, 75, 88. Unrestricted Thinking: the degree to which the student can produce ideas that are not directly or obviously related to the usual aspects of a situation. This ability is demonstrated by the student who is not "stimulus bound." For example, if the student were asked what the results would be if something happened, his answers would go beyond the situation described. If asked what would happen if people no longer needed food, he might respond with something like "world population would increase" rather than "no one would grow food."

26, 39, 76, 89. Persistence: the degree to which the student tends to maintain a course of thought or action until a task is completed. The student who is usually motivated to finish a task or assignment demonstrates this tendency. A very high rating on this scale means that the student manifests a need to continue tasks even when further effort is hopeless, as when the task is impossible. The student who shows severe discomfort when he cannot finish a task exhibits the extreme of this pattern. A very low rating on this scale means that the student usually is not motivated to complete tasks and has many unfinished projects around. In the extreme, the student may lack motivation to perform any task that requires sustained effort.

27, 40, 77, 90. Originality: the degree to which the student can produce clever, unusual, or "inventive" ideas. This ability is demonstrated by the student who can think of a novel idea that is different from the type usually produced by the class; he is especially noted for clever or witty ideas. This ability typically involves seeing a situation or problem in a new or unusual way.

28, 41, 78, 91. Need for Structure: the degree to which the student needs clear, explicit, external structuring of a situation and must have specific knowledge of the specific requirements of a task or situation. This need is demonstrated by the student who may ask many questions concerning what you want before he begins a task; he appears to feel discomfort in the face of uncertainty, indefiniteness, or unpredictability. A very high rating on this scale means that the student cannot begin a task without clear instructions. He may also evidence a strong need to categorize things into rigid classes, usually dichotomies such as "good" or "bad."

29, 42, 79, 92. Fluency: the degree to which the student can produce many ideas. This ability is demonstrated by the student who can make many contributions when you ask him to list or produce many items that fall under a particular category. Two examples of this type of task are: produce many synonyms for a given word; give many words that "begin with the letter S." This ability refers only to the quantity of ideas he can or will produce, not the quality of his ideas.

30, 43, 80, 93. Appreciation of Originality: the degree to which the student appreciates unique, clever, or unusual ideas. This tendency is demonstrated by the student who responds positively to unusual points of view, new songs, and novel activities. It may be expressed in a preference for "new twists" or surprise endings in stories. This scale is not intended to indicate the student's ability to produce novel or original ideas himself, but rather the nature of his response to original ideas regardless of source. A very high rating on this scale means that the student has a very great appreciation of originality. A very low rating on this scale means that the student either seldom displays an appreciation of original ideas or actively rejects them in favor of older, more familiar ideas.

Rating Scale Format. Graphic rating scales were adopted for this research. Each scale was a continuous horizontal line 3 inches long with the word "little" under the left end and the word "much" under the right end of the line. No center point was indicated, nor were any marks printed on the line. Each line was numbered in sequence: 1 through 9 on page 2; 10 through 18 on page 3; 19 through 27 on page 4; and 28 through 36 on page 5. Page 1 of each rating scale contained one of the descriptions cited above. On each page, the 9 lines were staggered in sets of 3, to avoid errors arising from visual perseveration. From the roster of children taking all tests and the Inventory, name rosters were prepared for each class in a template so cut out that the rater could place the template over the scale while evaluating the children, and a name would be collinear with the printed line. Only children in the study were rated, listed alphabetically within classes; the sequence of ratees was the same for each rating scale. The raters were instructed, in the manual, to make a vertical mark on each line indicating the degree to which that child possessed the attribute being rated. It was hoped that the format of the scales would minimize most of the common errors of ratings, especially those of central tendency and "halo."

Raters. Teachers in the cooperating school district were used as raters. The organization of the schools was such that a class of children would, for example, have one teacher for homeroom activities, English, and social studies, and another for mathematics and science. Another class might have homeroom activities with their mathematics and science teacher, and English and social studies with another. While it would have been of interest to group the ratings in terms of subject matter taught, an investigation of this possibility disclosed that the separation would not have been as neat as might be assumed from the example above. Because of the generally greater amount of time children spent with their homeroom teacher, regardless of subject matter, it was decided that the homeroom, non-homeroom separation was more easily accomplished and would be more interpretable.

Each child, then, was rated by two teachers, but always with the same class. The teachers were asked not to communicate their ratings to other teachers during the rating period.

Ratings Used. Teachers rated their classes in the fall and in the spring, as stated in an earlier section. The numerical value of the rating was determined by measuring the distance from the left end of the line to the rater's vertical mark, to the nearest 1/8 of an inch; the maximum range was thus from 0 to 24 for each child on each attribute. Distributions of the ratings for each attribute were made for each class-teacher combination and compared by inspection for marked aberrations in means or symmetry. There being none, the ratings as measured were pooled for all classes into the set of homeroom ratings and the set of non-homeroom ratings.

Correlations between homeroom and non-homeroom fall ratings were disappointingly low, confirming the tentative decision to treat them as separate criteria. It would appear either that the teachers interpreted the instructions and descriptions differently, or that they saw the children as exhibiting different behaviors. Correlations between fall and spring ratings, incomplete because of attrition and conflicts in schedules in the spring, were relatively large, as indicated in Table 6 where those values appear as reliability estimates. Consequently, although the generality of the ratings across teachers is in doubt, the ratings from each teacher are sufficiently stable to make a comparison of the multiple-regression results from homeroom and non-homeroom ratings of interest.

Table 6

Distribution Statistics for Ratings Used

A. BOYS: Homeroom Teacher

Rating	Mean[a]	σ	r_{tt}[b] (N=215)
18	10.29	5.21	.70
19	11.01	6.00	.70
20	10.16	5.49	.72
21	11.48	5.62	.25
22	10.70	4.90	.41
23	10.75	5.39	.63
24	11.24	5.29	.63
25	11.23	5.32	.61
26	11.12	5.66	.67
27	10.50	5.28	.64
28	12.52	5.03	.46
29	11.37	5.45	.66
30	12.04	4.44	.51

B. BOYS: Non-homeroom Teacher

Rating	Mean	σ	r_{tt} (N=86)
31	12.51	5.37	.74
32	11.83	5.35	.50
33	12.54	5.93	.64
34	12.07	4.92	.67
35	13.00	5.31	.55
36	12.81	5.85	.75
37	12.53	5.63	.67
38	12.56	5.44	.82
39	12.72	6.22	.74
40	12.59	5.50	.73
41	11.45	4.97	.49
42	12.69	5.69	.81
43	12.28	5.48	.73

C. GIRLS: Homeroom Teacher

Rating	Mean	σ	r_{tt} (N=205)
68	12.19	5.65	.70
69	7.68	5.56	.67
70	12.58	5.54	.64
71	10.23	4.74	.33
72	10.62	4.29	.52
73	12.25	5.34	.69
74	11.83	5.01	.58
75	11.63	5.23	.64
76	13.62	4.86	.61
77	11.69	5.01	.65
78	11.63	5.11	.38
79	12.42	5.27	.69
80	13.20	4.32	.49

D. GIRLS: Non-homeroom Teacher

Rating	Mean	σ	r_{tt} (N=99)
81	12.67	5.11	.57
82	11.17	5.20	.46
83	13.39	5.74	.70
84	11.50	4.68	.32
85	13.33	4.93	.31
86	13.32	5.52	.82
87	13.02	5.36	.66
88	13.00	5.17	.73
89	13.54	5.53	.73
90	13.31	5.11	.55
91	11.16	5.07	.59
92	13.32	5.84	.65
93	13.00	5.28	.64

[a] Means and standard deviations are for fall ratings. Only fall ratings were used as criteria.

[b] Correlation of ratings in Fall '60 with ratings in Spring '61. Re-ratings were not available from some non-homeroom teachers.

Recapitulation

From a total of 594 seventh-grade students in a cooperating school district in the southwest portion of the greater Los Angeles area, 443 were included in a study of the relationships of aptitude and trait measures to teacher ratings of behavioral aspects of creativity. Children were included if they had a total CTMM IQ of 90 or greater, and were present at the three class meetings when the aptitude and trait measures were collected.

Eight aptitude scores were derived from 6 tests modified from those recommended by Guilford and Merrifield (10) as measures of divergent thinking in semantic content. One score related to writing speed was also obtained. After extensive item selection, an Inventory of Children's Interests was prepared and administered. A series of four preliminary factor analyses of sets of about 60 items culminated in a final analysis of 80 items, from the results of which trait scales for eight dimensions of temperament and interest were derived. As the analysis of the Inventory was done for boys and girls separately, there were a total of ten factor analyses involved. Trait scales for boys and girls differ in essentially minor but interesting ways.

Teachers served as raters in completing graphic rating scales for each child on sixteen attributes, of which thirteen were used in the study. Because of differences in the ratings when each child was rated by two teachers, a separation into homeroom ratings and non-homeroom ratings was made.

For each kind of measure obtained (aptitude, trait, and rating), class distributions of values were inspected for marked differences in means, variances, or symmetry. There were no outstanding inter-class differences, so the raw scores were pooled for each measure for the entire sample. Lack of symmetry in the aptitude scores for the total sample resulted in their being converted to decile scores; similar problems in some of the trait scales led to their dichotomization, because their range was too small to permit any less costly transformation. Ratings were in general symmetric within the four subgroups for which multiple-regression solutions were obtained; boy, homeroom; girl, homeroom; boy, non-homeroom; and girl, non-homeroom.

RESULTS

This section of the report begins with a further specification of the general hypotheses concerning relationships among aptitudes, traits, and ratings. Then, the statistical evaluation of the hypotheses are presented and discussed.

Specific Hypotheses

Testing hypotheses stating that a difference, or a correlation, is zero tends to lend confidence to those who should be seeking predictive validity. A significant finding, based on the rejection of such an hypothesis, may be claimed, rightfully, for differences or correlations so small as to be of no practical use. Still, such a finding serves to comfort the investigator in the knowledge that he may be on the right track. In the discussions to follow, null hypotheses are stated with reference to correlation coefficients; explicitly, the hypothesis is that the correlation being discussed is zero, and, of course, the reason for discussing it is that the investigator wishes to reject it. Later, in the section dealing with multiple regressions, the emphasis shifts to prediction of teachers' ratings as criteria, and the utility of aptitudes as a group, traits as a group, and both combined.

In Table 7 the hypotheses made for this study are presented. Selected relationships are noted as good candidates for having significantly non-zero correlations. In the upper left corner, aptitudes are paired with traits, the latter for boys and girls separately. In the upper right corner, aptitudes are paired with ratings. In the lower left corner, traits and ratings are paired. In the aptitude-trait pairs, A denotes a positive relationship hypothesized from findings with adults (17); N denotes a negative relationship from the same source; x throughout the table denotes a logical positive relationship. Blank cells are those for which no strong relationship was expected.

Table 7

Hypothesized Relationships[a] of Aptitude and Trait Measures and Ratings

	Traits																Ratings												
	10	11	12	13	14	15	16	17	60	61	62	63	64	65	66	67	18	19	20	21	22	23	24	25	26	27	28	29	30
Aptitudes 1, 51		x								x							x				x					x			x
2, 52			x								x							x											
3, 53			A								A										x	x	x		x			x	
4, 54		x		N								N					x		x		x	x	x	x		x			x
5, 55			A			A		A			A			A				x					x					x	
6, 56							A								A		x		x							x		x	
7, 57	x					x			x					x			x		x							x		x	
8, 58		x		N								N					x		x		x			x		x			x
9, 59			A			A		A			A			x				x					x					x	
Ratings 18, 31, 68, 81					x	x	x			x	x		x	x	x	x													
19, 32, 69, 82			x								x																		
20, 33, 70, 83																													
21, 34, 71, 84			x							x																			
22, 35, 72, 85		x																											
23, 36, 73, 86							x									x													
24, 37, 74, 87						x				x				x	x														
25, 38, 75, 88											x																		
26, 39, 76, 89	x								x																				
27, 40, 77, 90		x			x	x							x	x															
28, 41, 78, 91				x								x																	
29, 42, 79, 92								x							x														
30, 43, 80, 93					x								x																
	10	11	12	13	14	15	16	17	60	61	62	63	64	65	66	67													

[a] Legend: x = logical positive relationship
A = premised positive from adult studies
N = premised negative from adult studies

The hypothesized relationships between aptitudes and traits were expected to be small, even though significantly non-zero. It is an error to think "the creative child is (some trait)," as some erstwhile typologists attempt (7); the form of that statement implies a strong validity, a confident prediction, and such are not simply obtained. The distinction, in geometric terms, is between collinearity and non-orthogonality of vectors. The latter may be achieved without the former being a necessary consequence.

In contrast, it was hoped that the relationships of traits to ratings and of aptitudes to ratings would be rather high, so that one could say: "Measurement X predicts what a teacher would agree is behavior Y." Accordingly, the obvious relationships to be inspected are those for which the names of trait or aptitude and rating are similar. In addition, where possession of a trait would engender the exercise of an aptitude, were it possessed, both were listed as predictors for the rating of behavior the teacher would be likely to see as a result of the trait-aptitude combination. Further, it will be noted that, while some ratings have the same set of aptitudes as predictors, the sets of traits differ, and conversely. The ratings were intended to be of different behaviors, and teachers had been so instructed.

Relations among aptitude scores were expected to be small, except for measures of the same factor; similarly, because they had been derived from orthogonal factors, the trait scores were expected to have essentially zero intercorrelations. As noted previously, it was hoped that the ratings would be separable, although past experience indicated a strong likelihood of a general or "halo" factor. It was expected that the rating for Creativity, as a composite, would be related to several other ratings.

Statistical Evaluations of Hypotheses

In this section, the empirical results will be discussed in the following sequence: aptitudes vs. traits; intercorrelations of ratings; and prediction of ratings from IQ, aptitudes, and traits. The inclusion of the IQ measure, Nos. 44 and 94, seemed necessary because of its sizable correlations with aptitude measures and ratings.

Aptitudes vs. Traits

The results of the intercorrelations of aptitudes and traits are presented in Table 8. The format, as indicated by the marginal numbers, is as follows: all correlations to the upper right of the main diagonal are for measures on boys; all those to the lower left of the main diagonal are for measures on girls. Intercorrelations of aptitudes are in the upper left quadrant of the table; those for traits are in the lower right quadrant. Correlations between aptitudes and traits are in the lower left quadrant, for girls, and in the upper right quadrant, for boys.

Table 8*

Intercorrelations of Aptitudes and Traits[a]

BOYS

		Aptitudes									Temperament Traits									
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	44	
	51		03	27	36	06	36	33	26	21	-08	04	08	-06	03	04	08	12	30	1
	52	20		17	06	21	01	-02	05	08	-03	-01	-06	05	07	18	11	-01	-06	2
	53	40	14		28	17	33	29	22	26	-21	-02	02	-09	04	18	13	-05	42	3
	54	46	12	43		-23	29	25	22	19	-06	02	-01	-14	05	15	15	07	31	4
Aptitudes	55	03	18	12	-42		15	31	15	30	-03	05	03	10	01	06	07	00	-12	5
	56	43	20	51	55	05		45	32	36	-15	-04	-04	-04	00	07	18	-04	35	6
	57	47	22	44	34	28	51		36	51	-07	03	04	-09	-07	07	15	13	25	7
	58	43	24	41	32	09	46	44		17	-10	-02	03	-13	10	14	11	10	28	8
	59	21	17	38	28	20	37	48	14		-06	00	05	-04	-10	02	08	03	12	9
	60	11	10	16	19	05	20	28	12	15		-19	06	25	-15	13	14	19	-24	10
	61	-09	08	-10	-09	07	-06	-04	-03	-12	02		18	-14	16	-07	06	-03	-02	11
	62	02	-06	-02	-19	04	-18	-13	-05	-12	-22	14		09	05	-12	02	-05	-09	12
	63	-28	-06	-12	-15	07	-20	-22	-24	-15	07	17	-08		-16	-03	01	13	-18	13
Temperament Traits	64	13	03	02	04	11	00	08	04	-01	-13	01	15	01		-01	04	-05	01	14
	65	15	10	08	20	-06	18	18	17	10	28	-03	-26	-04	03		23	16	02	15
	66	-06	01	-02	-09	08	00	04	05	-04	02	-01	10	-06	00	-04		26	19	16
	67	-15	04	-08	-18	05	-18	-16	-05	-15	-17	07	29	06	15	-18	-01		01	17
	94	46	-02	30	44	-15	44	37	31	22	09	-18	-11	-46	00	14	-07	-20		44
		51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	94	

GIRLS

* Decimal points omitted.

[a] See text for description of tabular arrangement.

The intercorrelations among the aptitude scores are not, in general, unreasonable; these same examinees had taken similar tests the previous year (18), and the intercorrelations of the same factors were not substantially smaller than those obtained here. However, two exceptions require comment. The relationship of Aptitude 9: What Would Happen - obvious, DMU, and Aptitude 7: Making A Plan, DMI, and also Aptitudes 54 and 57, is much stronger than one would expect if the factors are in fact orthogonal; a possible explanation is that Aptitude 9 is actually a measure of DMI, a premise not inconsistent with some previous indications (11). There is a possibility that, in the face of difficult scoring problems, scorers tend to differentiate in terms of abilities they themselves possess. As with most graduate students, IQ and verbal facility levels were high for the scorers in this study.

The intercorrelations for girls are noticeably larger than those for boys, as are the correlations of the nine aptitude scores with IQ-94. Perhaps this results from the higher means and standard deviations obtained by girls on most tests, although boys' and girls' tests were mixed for scoring.

Intercorrelations among trait measures were, as expected, generally low. They might have been somewhat larger, had the reliabilities been more substantial. Of interest are the negative correlations of IQ with Trait 10: Persistence and Trait 63: Need for Authority. The reader should recall that the traits for girls are not entirely parallel with those for boys.

The fate of the hypotheses about relationships between aptitudes and traits is rather enlightening. Of the 15 non-zero correlations expected for boys, three were among the 13 significantly non-zero correlations. For girls, of the 11 hypothesized, three were among the 25 significantly non-zero correlations. It is, thus, appropriate to turn to the inspection of the empirical results.

Trait 15: Self-confidence is related to measures of DMS (expressional fluency) and DMT (originality) for boys, and its parallel, Trait 65, is related to DMT, DMI (elaboration), DMR (associational fluency), and DMC (spontaneous flexibility) for girls. It may be that some form of self-censoring inhibits the performance, on divergent-thinking tests, of those who lack self-confidence. Persistence, Traits 10 and 60, is related to measures of DMS and DMR for both boys and girls, and to DMT and DMU (ideational fluency) for girls. Although Trait 13: Need for Rules and Trait 63: Need for Authority were named as nearly parallel for boys and girls, the pattern of relationships to aptitudes for the two differs; for boys, only DMT seems involved, while for girls, all but DMS are related to some degree. For boys, Trait 16: Adaptive Flexibility is related to measures of DMS, DMT, DMR, DMI, and IQ; its nearest match in the girls' sample, Trait 66: Tolerance of Ambiguity, has no relationships to the aptitudes measured. The relationships obtaining for Trait 67: Moral Relativism seem to indicate a modified interpretation of that trait for girls. Its consistent negative correlation with aptitudes, including IQ, its negative relationship to Trait 60: Persistence and Trait 65: Self-confidence, and its positive relationship to Trait 62: Lack of Restraint, seem to give it the aura of apathy, or perhaps of withdrawal.

To make a conclusion about the over-all relationships between aptitude measures and trait measures, the authors must reiterate that non-zero correlations are not grounds for prediction, and admit that the nuances of the interactions of these two aspects of personality need further delineation.

Intercorrelations of Ratings

Table 9 and Table 10 contain the intercorrelations of ratings by homeroom and non-homeroom teachers, respectively. As before, the upper right portion of the table is for boys, the lower left for girls. While it had been hoped that the teacher-raters would be able to differentiate the constructs described in the rating scale, it appears that the "halo" effect still shone through; the result is the more unexpected because the correlations are based on ratings of many teachers, each of whom rated only about 30 children. It is possible that differences in the leniency tendencies of the teachers, which would result in teachers' ratings having different means, could account for some of the correlation, but such differences were not apparent. At any rate, there seems to be a coterie of ratings—those whose lowest numbers are 18, 20, 23, 24, 27, 29, and 30—that could be described as a "problem-solving syndrome."[4] This grouping is more coherent in the non-homeroom ratings than in the homeroom ratings. The ratings for Need for Structure are generally negatively related to the others. Those, and the ratings for Need for Variety and Spontaneous Flexibility, have noticeably lower reliabilities than those in the syndrome (see Table 6).

[4] The reader may refer to pages 9 and 10, on which all four numbers for each rating are given.

Table 9*

Intercorrelations of Homeroom Teacher Ratings[a]

	18	19	20	21	22	23	24	25	26	27	28	29	30	44	
68		-07	73	02	34	68	61	60	57	68	-40	68	60	38	18
69	01		-26	48	18	-10	03	10	29	09	08	09	12	03	19
70	71	-16		-05	34	78	59	52	72	61	-30	61	59	38	20
71	12	33	12		13	07	10	15	-14	10	11	18	04	03	21
72	18	28	16	18		39	26	39	32	40	-18	35	43	20	22
73	71	-07	77	20	19		64	61	64	57	-34	62	64	35	23
74	69	00	64	17	08	69		57	55	57	-37	65	59	20	24
75	63	14	59	30	20	72	65		48	69	-30	68	60	25	25
76	63	-12	60	-07	15	62	47	56		59	-33	51	53	26	26
77	73	12	66	26	15	69	58	66	57		-27	73	63	30	27
78	-39	02	-29	-04	-03	-41	-38	-22	-26	-26		-32	-34	32	28
79	72	11	68	22	21	74	64	68	55	73	-32		65	32	29
80	64	06	64	18	19	66	62	56	49	60	-28	62		30	30
94	48	04	50	17	22	49	36	35	29	34	30	50	39		44
	68	69	70	71	72	73	74	75	76	77	78	79	80	94	

Table 10*

Intercorrelations of Non-homeroom Teacher Ratings[a]

	31	32	33	34	35	36	37	38	39	40	41	42	43	44	
81		-10	63	-12	51	63	57	57	67	63	-34	59	58	30	31
82	-07		-17	53	08	05	-05	00	-13	-04	30	05	-03	04	32
83	74	-08		-13	57	66	66	59	79	67	-26	58	61	42	33
84	-01	47	-03		09	-02	-04	03	-09	-01	21	06	04	02	34
85	55	18	57	22		52	55	50	58	54	01	56	48	35	35
86	67	-01	70	09	47		66	64	73	73	-19	70	59	39	36
87	60	-03	68	06	49	65		64	64	64	-21	59	65	29	37
88	69	-04	69	-01	54	72	65		63	67	-25	71	65	34	38
89	60	-07	64	-04	39	66	63	66		68	-19	69	64	34	39
90	60	04	62	09	58	67	63	65	63		-20	70	70	33	40
91	-29	20	-26	27	-09	-25	-17	-26	-27	-16		-18	-15	11	41
92	66	-04	74	-01	59	71	66	69	60	64	-24		63	34	42
93	60	-10	67	01	53	63	60	69	63	59	-27	69		33	43
94	46	12	51	04	32	38	29	43	33	33	31	43	39		44
	81	82	83	84	85	86	87	88	89	90	91	92	93	94	

* Decimal points omitted.

[a] See text for description of tabular arrangement.

Table 11*

Predictions of Homeroom Teacher Ratings, Boy Sample

	Aptitudes									Temperament Scale Scores								Predictor Set					
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	I	II	III	IV	V	VI
18	29	18	23	31	04	33	31	21	21	-12	01	-08	-11	-05	15	29	10	38	56[a]	53	47	37	50[c]
19	01	05	-06	04	-02	01	-03	10	-09	-10	17	04	-08	18	-02	-06	13	03	35[b]	35	18	30	22
20	20	14	26	23	01	28	24	15	18	-08	-04	-09	-06	-10	07	29	09	38	51[b]	48	39	36	45[c]
21	07	00	-07	06	00	08	02	10	-13	-09	11	07	-06	04	-02	-02	07	03	32	31	25	18	15
22	08	08	24	16	03	22	16	14	18	-20	05	02	-04	12	14	18	00	20	40[b]	40	31	33	30
23	21	15	21	26	01	30	23	19	16	-13	-07	-08	-05	-09	05	19	05	35	48[b]	45	40	30	41[c]
24	17	16	22	26	06	19	20	20	16	-07	06	-05	-11	04	10	20	14	20	41[b]	41	36	28	31
25	25	08	15	25	-05	24	17	16	11	-22	02	-09	-15	05	13	21	16	25	47[a]	47	35	39	39[c]
26	12	14	22	19	04	21	19	15	19	-04	-01	-11	-08	-08	12	20	07	26	40	38	32	27	30
27	20	14	20	26	-03	30	26	17	15	-17	04	-02	-08	-05	08	22	15	30	49[a]	48	41	35	41[c]
28	-15	-06	-23	-22	-04	-10	-11	-17	-07	10	-04	00	10	01	-10	-12	03	32	40	33	30	21	29
29	22	10	18	29	-04	26	27	20	10	-14	-01	-07	-08	01	05	21	15	32	47[b]	46	41	31	39[c]
30	15	10	20	22	-07	21	22	10	13	-14	04	-06	-11	05	-02	19	12	30	43	42	34	30	34

Table 12*

Prediction of Non-homeroom Teacher Ratings, Boy Sample

	Aptitudes									Temperament Scale Scores								Predictor Set					
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	I	II	III	IV	V	VI
31	06	03	21	12	-03	23	07	20	05	-13	00	00	-12	-01	09	12	05	30	40	36	32	24	29
32	-03	-04	-04	-01	03	-09	-07	03	-08	00	-01	06	-09	07	03	-14	08	04	28	28	16	24	00
33	23	01	24	17	-01	27	24	22	15	01	-05	08	-13	-06	09	16	06	42	50	42	37	27	44[c]
34	00	01	10	-07	14	-04	04	-02	00	-03	03	-02	-05	13	-05	-13	-06	02	30	29	20	20	09
35	15	-01	25	14	03	19	20	20	18	-15	-04	04	-18	00	11	04	09	35	45	39	32	30	36[d]
36	20	00	30	20	08	27	27	28	16	-08	-12	05	-15	-04	06	11	05	39	50[b]	46	41	29	44[c]
37	19	04	16	18	02	27	20	18	13	-07	-05	-03	-14	00	06	09	10	29	39	36	32	22	28
38	14	04	24	13	-01	31	18	27	23	-13	-15	-07	-16	05	03	10	05	39	50	47	42	30	42[c]
39	15	-03	27	15	03	25	21	25	16	-02	-18	01	-10	-07	14	15	06	34	47[b]	44	37	31	39[c]
40	20	08	30	22	02	24	23	22	15	-04	-02	11	-18	06	05	11	05	33	46[b]	43	38	27	39[c]
41	-06	-16	-07	-06	02	-13	-06	-02	03	15	-06	-03	12	-04	-04	-15	04	11	34	33	25	25	19
42	15	01	26	15	04	24	29	26	18	-06	-07	05	-10	03	09	10	10	34	45	41	38	24	37[d]
43	21	03	16	13	05	22	21	22	19	-09	-05	00	-20	07	04	09	07	33	43	38	31	27	34

Table 13*

Predictions of Homeroom Teacher Ratings, Girl Sample

	Aptitudes									Temperament Scale Scores								Predictor Set					
	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	I	II	III	IV	V	VI
68	40	11	31	42	-03	41	40	26	25	27	-06	-04	-19	-02	12	02	-16	48	61[a]	56	53	36	56[c]
69	13	14	03	02	09	14	09	09	01	03	13	12	-02	13	00	03	13	04	33	32	23	23	17
70	41	10	27	42	-04	40	35	27	26	27	-09	-13	-24	-05	23	-06	-22	50	62a	57	52	44	57[c]
71	26	12	13	28	-04	27	12	21	05	01	09	02	-10	07	-02	06	11	17	43[a]	43	36	21	34
72	18	-02	09	09	02	19	18	09	10	09	09	12	-17	04	-02	14	-03	22	38	37	25	29	26
73	42	10	29	46	-06	48	34	33	18	21	-08	-12	-21	01	18	-06	-19	49	62[a]	59	57	36	57[c]
74	35	16	27	38	-02	32	31	31	20	19	-14	-02	-13	-04	26	-01	-11	36	55a	53	47	35	49[c]
75	39	08	32	40	-05	39	26	33	13	24	05	-10	-12	-05	11	02	-06	35	56a	55	51	30	50[c]
76	26	03	28	28	-07	31	25	21	09	24	-09	-08	-03	-02	13	-04	-15	29	45b	44	39	28	36[d]
77	41	15	29	38	00	44	34	34	13	26	02	-04	-16	01	12	-01	-14	34	57[a]	56	53	34	51[c]
78	-15	-17	-12	-29	07	-19	-23	-17	-14	-13	04	05	07	-04	-11	-05	-07	30	45	39	35	21	36[d]
79	46	19	34	46	00	48	44	40	28	24	02	-04	-23	07	12	-09	-13	50	67a	63	61	39	63[c]
80	37	03	27	41	-08	34	29	30	19	24	-10	-07	-18	04	20	03	-14	39	54a	52	49	35	48[c]

Table 14*

Predictions of Non-homeroom Teacher Ratings, Girl Sample

	Aptitudes									Temperament Scale Scores								Predictor Set					
	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	I	II	III	IV	V	VI
81	33	08	19	23	-04	24	29	26	23	03	-21	-06	-27	00	08	-10	-20	46	54	48	41	38	48[c]
82	-03	10	02	-09	13	-01	06	08	00	-03	13	25	02	15	-11	09	17	12	37	36	19	31	23
83	30	-06	20	26	-07	25	30	27	29	01	-28	-12	-35	00	01	-12	-23	51	64a	59	47	49	59[c]
84	-16	00	-05	-14	14	-04	00	-07	01	-09	-01	02	-01	17	-10	10	17	05	34	34	23	27	20
85	16	01	08	14	-01	13	16	22	08	-07	-15	05	-25	11	-07	02	00	32	43	37	26	31	33
86	20	-02	24	17	-01	24	24	20	24	04	-22	-15	-24	-01	05	-03	-14	36	48	43	35	35	39[d]
87	22	01	16	06	12	17	28	20	24	10	-18	-12	-23	04	06	-09	-17	25	46[b]	44	36	35	37[d]
88	31	00	20	20	-02	22	28	26	21	05	-18	-03	-26	01	07	01	-16	43	50	45	40	34	42[c]
89	26	01	21	19	-06	21	26	21	22	08	-13	-10	-24	01	09	-09	-28	33	47	45	36	39	38[d]
90	19	-01	16	13	02	13	23	22	19	09	-16	-09	-26	04	06	-04	-10	33	43	40	32	33	34
91	-18	-05	-24	-26	10	-29	-22	-15	-19	-13	08	04	20	17	-07	-02	13	31	43	41	35	30	33
92	28	03	22	22	-04	24	25	24	25	07	-19	-11	-30	02	04	-01	-17	43	51	46	38	38	43[c]
93	22	-13	08	16	-07	17	17	19	13	06	-19	-10	-28	07	05	-01	-15	39	48	44	36	37	41[c]

KEY:
- I = IQ only
- II = IQ, aptitudes, temperaments
- III = aptitudes, temperaments
- IV = aptitudes only
- V = temperaments only
- VI = II reduced by estimated shrinkage

*Decimal points omitted.

[a] significantly greater than I, $p(F) < .01$.

[b] significantly greater than I, $p(F) < .05$.

[c] significantly greater than zero, $p(t) < .01$; assigned to shrunken values only.

[d] significantly greater than zero, $p(t) < .05$; assigned to shrunken values only.

Ratings Predicted from IQ, Aptitudes, and Traits

The large intercorrelations obtaining among the ratings make their separate consideration rather tenuous, although they are experimentally independent. Accordingly, the major emphasis in the discussion of the results will be on the prediction of the ratings for Creativity and Recognition of Implications, as a pair of indexes to the probable basic criterion used by the teachers. In Tables 11, 12, 13, and 14 the correlations of all ratings with all aptitudes, all traits, and IQ are presented. In the right-hand section of each table, predictions from six sets of predictors are listed; the most interesting questions are whether II (a composite of IQ, aptitudes, and traits) is significantly greater than I (zero-order correlation of ratings with IQ), and whether VI (the value from II reduced by estimated shrinkage) is significantly greater than zero.

Boy, Homeroom, Table 11. The results here are quite clear. Although IQ alone predicts Rating 18: Creativity and Rating 20: Recognition of Implications to some degree, the addition of aptitude and trait measures improves the prediction significantly. The shrunken values for the multiple-R remain significantly greater than zero, and appear to account for approximately 25% of the variability in the ratings. Results for other ratings in the "problem-solving syndrome" are consistent, except for Rating 30: Appreciation of Originality.

Boy, Non-homeroom, Table 12. In this situation, IQ seems to play a stronger role, relative to the measures of aptitudes and traits. Except for Rating 31: Creativity, the syndrome effect persists, although weaker than with the homeroom ratings. This result is not entirely unexpected; non-homeroom teachers see the children less, and in situations in which the major emphasis is on learning; thus, a greater involvement of IQ is understandable.

Girl, Homeroom, Table 13. As with the boy, homeroom, situation, Rating 68: Creativity and Rating 70: Recognition of Implications are predicted better with the addition of aptitude and trait measures to the predictor set, and the shrunken multiple-R is well above zero, accounting for about 30% of the variance in the ratings. The multiple-R's are larger than those for boys, and the rating for Rating 80: Appreciation of Originality is successfully predicted.

Girl, Non-homeroom, Table 14. The results in this situation are better than those for boy, non-homeroom, but not quite as satisfying as those for girl, homeroom. It is of interest that the prediction of Rating 83: Recognition of Implications again exceeds that of Rating 81: Creativity and is, in fact, the highest validity reported in all situations, for the two major indexes. Other ratings in the syndrome are consistently predicted.

Two-variable Correlations. In terms of the "problem-solving syndrome" suggested as the underlying basis of the ratings, it is interesting to note the fairly consistent pattern in the two-variable correlations of aptitude and trait measures with Rating 18: Creativity and Rating 20: Recognition of Implications. For the boy, homeroom, and girl, both homeroom and non-homeroom, the correlations of Aptitude 1: DMC and Aptitude 6: DMR are consistently sizable. The arbitrary cut-off used in categorizing this correlation is .25, a value well above the level of chance success, but yet not really large enough to suggest the use of that variable as a single predictor of the rating. Both measures of DMT are good candidates for the "useful" category, more in girls, Aptitudes 14 and 18, than in boys, Aptitudes 4 and 8. In general, the correlations from the girl samples are higher than from the boy samples, and those from homeroom situations higher than from the non-homeroom. The poorest showing of all is in the boy, non-homeroom comparison.

If one looks at individual ratings, keeping in mind the large intercorrelations of ratings, he will note the consistently strong prediction of Rating 27: Originality and, to a lesser extent, Rating 29: Fluency by all the aptitude measures except Aptitude 2: Marking Speed and Aptitude 5: DMU; the latter's companion for DMU, Aptitude 9, is more highly correlated with Ratings 27 and 29, though not strikingly so.

The zero-order correlations of trait scores and ratings are not encouraging, the large majority being very near to zero. There is a hint of positive relationship with Traits 15 and 65: Self-confidence in homeroom ratings, but not in non-homeroom ratings. Trait 16: Adaptive Flexibility is related to most ratings for boy, homeroom, but not elsewhere. In girl, non-homeroom, the negative relationship of Trait 63: Need for Authority with most of the ratings is interesting, especially as the trend is not as marked in girl, homeroom, nor with the companion Trait 13: Need for Rules in either of the boy samples. An inconsistency between the trends for Traits 10 and 60: Persistence in the two homeroom groups is hard to explain. Perhaps the trait in boys (negative relationship) is viewed as stubbornness, and in the girls (positive relationship) as acquiescence. Unfortunately, the items on which the trait measure is based are rather free of content specifically related to school objectives, so it is not possible to say whether boys and girls are "persistent" toward different goals.

Discussion

In this section, the results of the data reduction were presented. Intercorrelations among aptitude measures were higher than expected, although not so large as to confound too grossly the results. As a result of the factor-analytic derivation of trait measures, the trait scores were essentially uncorrelated; unfortunately, the reliabilities were rather low. Intercorrelations of ratings were much higher than expected; in fact, the results were indicative of a basic "problem-solving syndrome," which formed the major criterion in the discussion of prediction of children's behavior.

In the large view, the IQ measures appeared to account for about 15% of the variability in teacher ratings of creativity and recognition of implications, the two components selected to represent the "syndrome." The addition of measures of aptitudes and traits together increased the predictability to about 25%. It appeared that aptitude measures were more highly related to ratings than were the trait measures, although the lower reliability of the traits may have inhibited their correlations with other variables.

SUMMARY

The objectives of this investigation had one major focus: Can measures of constructs said to be related to creativity be useful in predicting teachers' ratings of creativity? Believing that creativity was a composite, the authors selected nine tests of six factors from the divergent-semantic section of Guilford and Merrifield's (10) structure-of-intellect model; the tests had been successfully used in identifying factors in ninth-grade and sixth-grade groups. Trait measures were developed by factoring the intercorrelations of 121 inventory items especially selected or written for this study. The factor analysis resulted in eight trait scales for boys and, from a separate analysis for girls, eight trait scales not entirely similar to those for boys. Graphic rating scales were used by homeroom and non-homeroom teachers to rate 16 behavior patterns, of which 13 were used as criteria in the study.

The sample tested in 1960 was formed of 227 boys and 216 girls in the seventh grade of an elementary school system in a suburb of Los Angeles. The same children had been tested the previous year, but test items and format were changed for the instruments used in this study. Each child was rated by two teachers, and each teacher rated approximately 60 children, 30 in a homeroom and 30 in a non-homeroom situation.

Data reduction showed reasonable intercorrelations among aptitude scores and among trait scores; correlations between aptitudes and traits were not large. Intercorrelations among ratings were unexpectedly high. Either teachers were not able to differentiate the constructs used in the separate rating scales or the constructs are correlated in the sample. The authors would prefer the first alternative, and adduce the lower relations among aptitude measures as supporting evidence. Teachers were oriented toward the separateness of the constructs, but more time and more rigorous thinking evidently need be invested in preparing teachers to rate in terms of the subtleties involved, which are not entirely intuitive. The underlying basis of the teachers' ratings was interpreted as a "problem-solving syndrome."

The predictive utility of the measures of aptitudes and traits was evidenced by an increase in the coefficient of determination from about 15%, using just IQ as a predictor of ratings, to about 25%, using a composite of IQ, other aptitudes and traits. In terms of individual rating-aptitude correlations, the "problem-solving syndrome" was related to aptitude measures for the factors DMC (spontaneous flexibility), DMR (associational fluency), and to a lesser extent, for the factor DMT (originality). There were no really striking relationships between ratings and trait scores.

In terms of the objectives stated at the beginning of this report, the following comments seem appropriate.

1. Tests of divergent thinking do differentiate seventh-grade children in ways similar to their results with adults.

2. Non-aptitude traits can be defined and reasonably interpreted; reliabilities are regrettably low, so that comments about relations between aptitude and non-aptitude measures cannot be clearly supported. However, these relations seem to be generally low.

3. The non-aptitude traits emergent for boys differ somewhat from those emergent for girls. There seem to be no psychologically interesting patterns in the differences.

4. Teachers may need much more intensive training than given in this study, if they are to evaluate aspects of creative behavior in a fashion analogous to that indicated by aptitude and trait differentiations. In this study, teachers seemed to agree, in the sense that their ratings were highly intercorrelated, that a sort of "problem-solving syndrome" underlies their notion of creativity. The similarity of these two constructs has been noted by other investigators. The prediction of the ratings for the "syndrome" was possible, to a small degree (15%) by IQ alone; the prediction was improved to about 25% by the addition of aptitude and trait measures to the predictor set.

For future research, it seems necessary to develop training programs for raters of creativity, problem-solving, and their several components. Further work, preferably factor-analytic, is needed to improve the reliability and interpretability of non-aptitude traits. Finally, the differentiation that was obtained in this study in terms of aptitudes and traits reconfirms the potential utility of more flexible curricular programming at the elementary school level, with the objective of enhancing the development of each child as an individual.

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